Investigations Folio: Investigation Design



Factors that affect Drag

**Purpose**

This assessment enables you to demonstrate your ability to:

* design and conduct an investigation
* identify and discuss variables
* collect, analyse, and interpret data
* evaluate results
* form conclusions
* communicate your understanding of the physics concepts relating to drag.

**Purpose of the investigation**

To investigate the relationship between the velocity of a falling patty pan and a selected property of the patty pan.

**Description of assessment**

**Assessment conditions**

The practical is to be carried out by your group during one supervised 100 minute lesson. You will be monitored on your safe and effective use of equipment and your work skills as part of a team. Part A of the written report is to be completed individually under test conditions and submitted after 40 minutes. Part B is a group task to collect the data, but the written report is to be completed individually and submitted one week later at the start of the lesson.

**Apparatus:** Each group will have access to a set of 10 gram slotted masses, 3 stopwatches, 4 metre rulers, ultrasonic motion sensor attached to a computer, numerous patty pans of different sizes that are made from various materials such as paper or alfoil.

**YOUR TASK:**

**Part A: Test conditions, individual report**

Design your own practical to investigate how one factor may affect the velocity of a falling baking case.

**Assessment criteria:**

**I1:**

State a hypothesis.

Write a detailed procedure in your own words, including a labelled diagram.

Select and state your independant variable and explain why it is the independant variable.

State your dependant variable and explain why it is the dependant variable.

Discuss the variables that need to be controlled and explain how you will do this for each trial.

**Part B: Group work**

Submit your written investigation design and then discuss the different designs with each of the members of your group. Select one of your group’s factors to investigate and carry out the investigation.

**I3 and A3:**

Write a paragraph about how cooperatively and constructively your group worked; and explain

what contributions you made to your group.

You will also be monitored during the lesson on your individual and collaborative work skills and

your ability to manipulate apparatus carefully and effectively.

**I4:**

Collect, record and display your results in an effective manner:

Make sure your table records your data for all trials, has clear headings and units. The data should

be recorded to the correct number of significant figures.

Draw at least one graph with a line of best fit.

**AE2:**

Explain what a random error is.

Explain what a systematic error is.

Evaluate your procedure by identifying the various errors involved and discussing their effect.

Discuss ways of improving your procedure to reduce errors, improve reliability and improve accuracy.

**AE1:**

Analyse and evaluate your data and graph to formulate a conclusion.

Discuss any physics concepts that may be connected to your results.

Make a prediction about further experiments that could be done on this factor or on the other factors

suggested by the group.

**KU3:**

Use a variety of formats to communicate your knowledge and understanding of physics effectively.

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| ***Learning Requirements*** | ***Assessment Design Criteria*** | ***Capabilities*** |
| 1. identify and formulate questions, hypotheses, concepts, and purposes that guide investigations in physics  2. design and conduct collaborative and individual investigations in physics using appropriate apparatus and safe working practices and by observing, recording, and interpreting the phenomena of physics  3. represent, analyse, interpret, and evaluate investigations in physics through the use of technology and numeracy skills  4. select, analyse, and critically evaluate the evidence of physics from different sources, and present informed conclusions or decisions on contemporary physics applications  5. communicate knowledge and understanding of the concepts and information of physics using appropriate physics terms and conventions  6. demonstrate and apply knowledge and understanding of physics to a range of applications and problems. | Investigation  The specific features are as follows:  I1 Design of physics investigations.  I2 Selection and acknowledgment of information and data about physics and issues in physics from different sources.  I3 Manipulation of apparatus and technological tools to implement safe and ethical investigation procedures.  I4 The obtaining, recording, and display of findings of investigations using appropriate conventions and formats.  Analysis and Evaluation  The specific features are as follows:  AE1 Analysis and evaluation of data and other evidence to formulate conclusions and make relevant predictions.  AE2 Evaluation of procedures, with suggestions for improvement.  Application  The specific features are as follows:  A1 Application of physics concepts and evidence from investigations to solve problems in new and familiar contexts.  A2 Use of appropriate physics terms, conventions, formulae, and equations.  A3 Demonstration of skills in individual and collaborative work.  Knowledge and Understanding  The specific features are as follows:  KU1 Demonstration of knowledge and understanding of physics concepts.  KU2 Use of knowledge of physics to understand and explain contemporary applications.  KU3 Communication of knowledge and understanding of physics in different formats. | Communication  Citizenship  Personal Development  Work  Learning |

**Performance Standards for Stage 2 Physics**

|  | Investigation | Analysis and Evaluation | Application | Knowledge and Understanding |
| --- | --- | --- | --- | --- |
| A | Designs logical, coherent, and detailed physics investigations.  Critically and logically selects and consistently and appropriately acknowledges information about physics and issues in physics from a range of sources.  Manipulates apparatus and technological tools carefully and highly effectively to implement well-organised safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using appropriate conventions and formats accurately and highly effectively. | Critically and logically analyses and evaluates connections between data, concepts, and issues in physics.  Critically and logically evaluates procedures and suggests a range of appropriate improvements.  Systematically and perceptively analyses and evaluates data and other evidence to formulate conclusions and make logical and highly relevant predictions. | Applies physics concepts and evidence from investigations to suggest solutions to complex problems in new and familiar contexts.  Uses appropriate physics terms, conventions, formulae, and equations highly effectively.  Demonstrates initiative in applying constructive and focused individual and collaborative work skills. | Consistently demonstrates a deep and broad knowledge and understanding of a range of physics concepts.  Uses knowledge of physics perceptively and logically to understand and explain contemporary applications.  Uses a variety of formats to communicate knowledge and understanding of physics coherently and highly effectively. |
| B | Designs well-considered and clear physics investigations.  Logically selects and appropriately acknowledges information about physics and issues in physics from different sources.  Manipulates apparatus and technological tools carefully and mostly effectively to implement organised safe and ethical work investigation procedures.  Obtains, records, and displays findings of investigations using appropriate conventions and formats mostly accurately and effectively. | Clearly and logically analyses and evaluates connections between data, concepts, and issues in physics.  Logically evaluates procedures and suggests some appropriate improvements.  Uses mostly logical analysis and evaluation of data and other evidence to formulate conclusions and make consistent and relevant predictions. | Applies physics concepts and evidence from investigations to suggest solutions to problems in new and familiar contexts.  Uses appropriate physics terms, conventions, formulae, and equations effectively.  Applies mostly constructive and focused individual and collaborative work skills. | Demonstrates some depth and breadth of knowledge and understanding of a range of physics concepts.  Uses knowledge of physics logically to understand and explain contemporary applications.  Uses a variety of formats to communicate knowledge and understanding of physics coherently and effectively. |
| C | Designs considered and generally clear physics investigations.  Selects with some focus, and mostly appropriately acknowledges, information about physics and issues in physics from different sources.  Manipulates apparatus and technological tools generally carefully and effectively to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using generally appropriate conventions and formats with some errors but generally accurately and effectively. | Analyses and evaluates connections between data, concepts, and issues in physics.  Evaluates some procedures in physics and suggests some improvements that are generally appropriate.  Analyses and evaluates data and other evidence to formulate conclusions and make simple and generally relevant predictions. | Applies physics concepts and evidence from investigations to suggest some solutions to basic problems in new or familiar contexts.  Uses generally appropriate physics terms, conventions, formulae, and equations with some general effectiveness.  Applies generally constructive individual and collaborative work skills. | Demonstrates knowledge and understanding of a general range of physics concepts.  Uses knowledge of physics with some logic to understand and explain one or more contemporary applications.  Uses different formats to communicate knowledge and understanding of physics with some general effectiveness. |
| D | Prepares the outline of one or more physics investigations.  Selects and may partly acknowledge one or more sources of information about physics or an issue in physics.  Uses apparatus and technological tools with inconsistent care and effectiveness and attempts to implement safe and ethical investigation procedures.  Obtains, records, and displays findings of investigations using conventions and formats inconsistently, with occasional accuracy and effectiveness. | Describes basic connections between some data, concepts, and issues in physics.  For some procedures, identifies improvements that may be made.  Attempts to extract meaning from data and other observations and to formulate a conclusion or make a simple prediction that may be relevant. | Applies some evidence to describe some basic problems and identify one or more simple solutions, in familiar contexts.  Attempts to use some physics terms, conventions, formulae, and equations that may be appropriate.  Attempts individual work inconsistently, and contributes superficially to aspects of collaborative work. | Demonstrates some basic knowledge and partial understanding of physics concepts.  Identifies and explains some physics information that is relevant to one or more contemporary applications.  Communicates basic information to others using one or more formats. |
| E | Identifies a simple procedure for a physics investigation.  Identifies a source of information about physics or an issue in physics.  Attempts to use apparatus and technological tools with limited effectiveness or attention to safe or ethical investigation procedures.  Attempts to record and display some descriptive information about an investigation, with limited accuracy or effectiveness. | Acknowledges that connections exist between data, concepts, and/or issues in physics.  Acknowledges the need for improvements in one or more procedures.  Attempts to organise some limited data or observations. | Identifies a basic problem and attempts to identify a solution in a familiar context.  Uses some physics terms or formulae.  Shows emerging skills in individual and collaborative work. | Demonstrates some limited recognition and awareness of physics concepts.  Shows an emerging understanding that some physics information is relevant to contemporary applications.  Attempts to communicate information about physics. |